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25X1

Monthly Report

PAR 245

29 Jul 66

SUBJECT: BPE High-Magnification Lens Sets

TASK/PROBLEM

1. Design, fabricate, and test prototype optical systems to extend the Briefing Print Enlarger (prototype) PAR 243, upper limit magnification range from 60X to 140X - 160X.

DISCUSSION

2. The design of both lenses has progressed nearly to completion. The 60X to 95X lens is presently an eight-element design and is in the final formula touch-up phase. The 95X to 150X lens is presently a seven-element design similar to the N-102 formula and theoretical evaluation indicates this formula to be satisfactory. Final checking of glasses and edge thicknesses for mounting is in progress.

PLANNED ACTIVITY

3. When both objective lens formulas are satisfactorily completed, start design of the condenser lens systems.

Declass Review by NGA.

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AND DECLASSIFICATION

| TITLE <u>BPE Lens set 61-160X</u> | | CATEGORY <u>Reproduction</u> 25X1 PFN | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--|---|----------|-----|-----|-----|-------|-----|-------|------|------|------|-----|------|-----|-------------|--|--|--|--|--|--|--|--|--|--|--|--|--|---|----|----|----|---|----|----|----|---|---|----|----|----|---|
| CONTRACTOR <u>[Redacted]</u> | | CONTRACT DATE <u>2-1-66</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CONTRACT NO. <u>[Redacted]</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | <table border="1"> <thead> <tr> <th>NOV</th> <th>DECEMBER</th> <th>NOV</th> <th>DEC</th> <th>JAN</th> <th>FEB</th> <th>MAR</th> <th>APRIL</th> <th>MAY</th> <th>JUNE</th> <th>JULY</th> <th>AUG</th> <th>SEPT</th> <th>OCT</th> </tr> <tr> <th colspan="14">WEEK ENDING</th> </tr> <tr> <th>6</th> <th>13</th> <th>20</th> <th>27</th> <th>4</th> <th>11</th> <th>18</th> <th>25</th> <th>2</th> <th>9</th> <th>16</th> <th>23</th> <th>30</th> <th>6</th> </tr> </thead> </table> | NOV | DECEMBER | NOV | DEC | JAN | FEB | MAR | APRIL | MAY | JUNE | JULY | AUG | SEPT | OCT | WEEK ENDING | | | | | | | | | | | | | | 6 | 13 | 20 | 27 | 4 | 11 | 18 | 25 | 2 | 9 | 16 | 23 | 30 | 6 |
| NOV | DECEMBER | NOV | DEC | JAN | FEB | MAR | APRIL | MAY | JUNE | JULY | AUG | SEPT | OCT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| WEEK ENDING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | 13 | 20 | 27 | 4 | 11 | 18 | 25 | 2 | 9 | 16 | 23 | 30 | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSPECTION REPORTS TO <u>Q/L</u> | <u>NA</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TRIPS | <u>[Box]</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MONTHLY REPORT FROM CONTR. | <u>[Box]</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INTERIM REPORT FROM CONTR. | <u>NA</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| INSTALL. INFO. FROM CONTR. | <u>NA</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPIC SITE PREPAR. | <u>NA</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| TEST SPEC. APPVL. | <u>*</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OP. MANUAL APPVL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| MAINT. MANUAL APPVL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ACCEPT TEST- <u>(3)</u> | <u>[Box]</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| EQUIP. DELIVERY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NPIC ACCEPT. TEST | <u>[Box]</u> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FINAL REPORT FROM CONTR. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FINAL EVAL REPORT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| REMARKS: | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>2. See PAR 243 SPEC 2 PAR 245 Manual 8,</p> <p>3. Test possibly at NPIC</p> | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

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Monthly Report

PAR 245

30 Jun 66

SUBJECT: BPE High-Magnification Lens Sets

TASK/PROBLEM

1. Design, fabricate and test prototype optical systems to extend the Briefing Print Enlarger (prototype) PAR 243, upper limit magnification range from 60X to 140X - 160X.

DISCUSSION

2. On 6 Jun 66 we were authorized by message 7391 to proceed with this project.

3. Specification 469334, for the optical design of two lenses and an associated condenser system for each, was prepared and released on 8 Jun 66. This specification was discussed with the contractor's optical design group.

4. On 9 Jun 66 the contractor's optical design group was authorized to proceed with the design of the objective lenses and condenser assemblies.

PLANNED ACTIVITY

5. Continue the optical design effort.

See Specification 469334 which is attached.

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Attachment to:

PAR 245

30 Jun 66

SPECIFICATION 469334

HIGH MAGNIFICATION LENSES FOR BPE (4600A)
(Released 8 Jun 66)

- 1.0 Objective and condenser lens sets to provide 60X to 150X magnification in the Briefing Print Enlarger.
- 2.0 This specification describes two objective and condenser lens sets to be used for enlargement of high definition black-and-white aerial photographs. These lenses extend the magnification range of the BPE upward from 60X to 150X.
- 3.0 UNUSUAL REQUIREMENTS
 - 3.1 The enlarger, with the subject lenses, must provide any magnification ratio from 60X to 150X to a 20" x 24" print. The data of Table I were derived by thin lens formulae and show a tentative pair of lenses meeting requirements with a maximum semi-field angle of about 18° and with object-to-image distances of 50 to 80 inches.
 - 3.2 The negative will be held between flat glass surfaces wet by index matching fluid. The gate element on the objective lens side should be plano-plano glass, 3.0mm thick. The gate element on the lamp side should be plano-plano glass, 6.0mm thick.
 - 3.3 The condenser system should include 2 - 4mm thick heat absorber elements (Pittsburgh No. 2043) and allow space for insertion of a color filter at a position protected from the lamp heat by both heat absorber elements.

The distance from the negative plane to the color filter should be between 1.75 and 3.56 inches. The minimum air space for the color filter is 0.32 inch.
 - 3.4 The condenser system should be designed to project a 12.3mm filament diagonal to fill 95% of the projector lens aperture. The envelope of the lamp will be up to 0.81 inch from the filament plane.

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3.5 The use of a methacrylate condenser element with an aspheric surface may be considered where adequate spherical correction of the condenser system would otherwise require several elements. The plastic element cannot be in contact with the negative and the immersion fluid nor next to the lamp.

4.0 FOCAL LENGTH

See Table 1.

5.0 RELATIVE APERTURE

See Table 1. The apertures specified may be reduced to f/2.8 if improved definition can be achieved. The lens aperture will be fixed in fabrication and need not be capable of later adjustment.

6.0 FIELD OF VIEW

See Table 1.

7.0 MAGNIFICATION

See Table 1.

8.0 FIELD ILLUMINANCE OR VIGNETTING

The illuminance at the maximum field radius specified in Table 1 shall not be less than 70% of that on the system axis.

9.0 TRANSMITTANCE

Not specified.

10.0 ACHROMATISM

The system will be used with narrow band blue filters. Correction 4600A with achromatization at 4200A and 5000A is suggested.

11.0 SPACE OR SIZE LIMITATIONS

See Table 1. Also, the lamp-centerline-to-negative-plane distance should not exceed about ten (10) inches. If this becomes difficult, please consult the project engineer.

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12.0 SPECIAL MATERIALS

Domestic glass is desired but if higher performance is obtainable with imported glass it should be used.

13.0 PERFORMANCE

13.1 For each of the lens design as computed at 61.5" overall conjugate and $\lambda = 460 \text{ m}\mu$, the design goal is to have 90% of the computed rays fall within:

- a. A circle equal to the diameter of the first minimum of the diffraction pattern to 6° (or more) off axis.
- b. A circle twice the diameter of the first minimum to 12° (or more) off axis, and
- c. A circle 4X the diameter of the first minimum to 18° (or more) off axis.

13.2 Report

Upon completion of the designs, the project engineer requires formula sheets and energy distribution diagrams at 0° , 6° , 12° , and 18° off axis for the three overall conjugate distances indicated in Table 1 for each of the designs before sample fabrication is begun.

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TABLE IOBJECTIVE LENSES, HIGH MAGNIFICATION, FOR BPE

| <u>Lens</u> | <u>Nom. E. F.</u> | <u>Relative Aperture</u> | <u>Magn.</u> | <u>O.A.C.</u> | <u>Field Radius</u> | | <u>Approx. Field Angle</u> |
|-------------|-----------------------|------------------------------|--------------|---------------|---------------------|-------------------|--------------------------------|
| | | | | | <u>Short Conj.</u> | <u>Long Conj.</u> | |
| G | 0.810" | f/2.6 | 59.9X | 50" | .260" | 15.6" | 17° 40' |
| | | | 74.7 | 62" | .260" | 19.4" | |
| | | | 97.0 | 80" | .260" | 25.2" | |
| H | 0.517" | f/2.2 | 94.9 | 50" | .165" | 15.6" | 17° 40' |
| | | | 118. | 62" | .165" | 19.4" | |
| | | | 153. | 80" | .165" | 25.2" | |

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